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MICROALGAE
for your rotifer cultures

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Today it is common to use rotifers *B. plicatilis* and *B. rotondiformis* as live prey for marine fish larvae as they are an important source of nutrition during the larvae's first few weeks. Even though these zooplankton are rich in protein, as well as linolenic and linoleic acid n-6 PUFA's, they naturally lack sufficient amounts of essential n-3 HUFA's. With the larvae's inability to synthesize the linoleic acid into essential fatty acids, it is required that the live prey is correctly and sufficiently enriched with eicosapentaenoic (EPA), docosahexaenoic (DHA) and arachidonic acid (ARA).

It is therefore pivotal that the microalgae fed to rotifers, either directly in its tanks or through Green Water, has the required nutritional and fatty acid values to provide the best enrichment and maximum growth of them. This regardless if you cultivate your own microalgae or purchase concentrated paste from a third party.

The most frequent microalgae genera used by hatcheries as feed and enrichment for rotifers are *Nannochloropsis, Isochrysis, Pavlova, Tetraselmis* and *Chlorella*. All these contain proteins and vitamins at different levels and some are rich in DHA, others in EPA and ARA. Due to the different nutritional profiles of these genera, a mixture is normally fed to give the best balance between rotifer growth, egg production and fatty acid enrichment.

A rule of thumb for live prey to be used as marine larvae enrichment is that the DHA: EPA ratio shall be above one, with a tad of ARA on top of it. It must, however, be remembered that live prey's ability to absorb essential fatty acids from different microalgae genera varies widely between prey types.

Therefore, the feeding rates of microalgae for different zooplankton must be analysed and adjusted accordingly (Sargent et al. 1999).

Microalgae species

Several microalgae species are capable of producing high amounts of fatty acids, including the essential EPA, DHA and ARA.

From our own experience though, we've seen that results obtained under small-scale laboratory conditions might not easily

be transferrable to a larger scale production of the very same strains. Many scientific studies regarding induction of fatty acid production in microalgae revolves around the adjustments of light, temperature, pH value, water quality, salinity, growth media, or the application of stresses and sudden shifts in culture conditions.

Under laboratory conditions, this is feasible owing to the relatively small volumes used in experimental setups. Applying these parameters on a larger on-site production is often more challenging.

Having emphasis on strain selection and controlling nutrient composition is fairly straightforward, but to get constant pH levels, optimum temperature levels, and desired water quality as well as inducing shifts and stresses in the culture for it to produce the fatty acid levels described in scientific papers is often more challenging.

The need for precise control of conditions

At our production facility in northern Denmark we have therefore put great attention on getting these parameters under control by using LED lights and a software-controlled temperature and pH sensor system in our proprietary photobioreactor systems.

From our experience we've also seen that the very same strain of microalgae can behave significantly differently even under slight changes in the salt, mineral and nutrient composition of the growth media. For this reason we always formulate our own artificial sea water in which we can exactly control what's in our growth media and at the same time eliminate the risk of waterborne pathogens and contaminants being brought in to our cultures via collected seawater.

Another important aspect also lies in choosing the right microalgae strains, as some strains even though they are from the same species, will produce higher levels of n-3 HUFA's than others (Ma et al. 2014). It is also important to remember that inducing fatty acid formation in microalgae via stress will most often be at the cost of growth since the metabolic pathways in the cells will be redirected into energy storage.

It must therefore be a balance between achieving the right fatty acid composition and at the same time maintaining acceptable culture growth of the microalgae.

Hatchery practices

To a greater or lesser extent, many hatcheries today cultivate their own microalgae. From what we have seen, the nutritional profile can change, not only when going from the lab into larger scale production, but also when parameters such as light, temperature, and composition within the growth media changes.

Therefore, to ensure your microalgae has the fatty acid, protein, and vitamin composition you think it does, a profiling of your microalgae cultures on a regularly basis is advisable. Since without it, it is difficult to determine the nutritional value that your rotifer is providing to your larvae. And as most hatchery managers know, early rearing mistakes can amplify throughout the growth stages of the fish.

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